International University

School of Electrical Engineering

Individual Project Report

Topic: Calculator using Atmega32

Submitted by

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Table of Contents

Introduction

The “Calculator” project using ATmega32 microcontroller is a basic calculator application implemented on ATmega32 microcontroller. In this project, you can perform addition, subtraction, multiplication and division. The project uses drivers for GPIO, 16x2 LCD display and keypad for user interaction. The source code has been thoroughly commented to explain the function of each line of code. For use in Proteus simulation, you can open the Proteus simulation file included in the project and interact with the virtual keyboard and LCD display.

Experimental Procedure

1. **Preparation**

Table 1. Essential components to build a circuit

No.	Name(s)	Quantity
1	Diode 1N8504	1
2	Tip 2955	1
3	LM 7805	1
4	Atmega32	1
5	LCD 16x2	1
6	Vr 10k	1
7	Button	1
8	Switch 3 Pins	1
9	Switch 5 Pins	2
10	Adapter 5V	1
11	Capacitors	1
12	Header	7
13	Led	1
14	Crystal 16mhz	1
15	Keypad 4x4	1

2. **Functions of some elements and applications of the circuit**

- **Atmega 32**: ATmega328/328P is an Advanced Virtual RISC (AVR) microcontroller . It supports 8-bit data processing. ATmega-328/328P has 32KB internal flash memory. ATmega328/328P has 1KB Electrically Erasable Programmable Read-Only Memory (EEPROM)
- **TIP 2955**: The TIP2955 is a -60V Silicon PNP Complementary Power Transistor designed for general purpose amplifier and low speed switching applications.
- **IC 7805**: A voltage regulator IC that provides a constant 5V output. It's widely used in electronic circuits to provide a stable power supply for TTL IC's and other 5V logic circuits.
- **LCD 16x2**: A highly versatile timer IC used for generating precise timing pulses, and it can operate in both monostable and astable modes. It's used in a variety of applications including pulse generation and time delay functions.
- **On/off Switch**: A switch that toggles the state of a circuit between on (closed) and off (open), controlling the flow of electricity. When closed, it allows current from the 9V DC to power the circuit.
- **9V adapter**: The power source for the entire circuit.
- **Capacitors :** The capacitors using to filtering frequencies and block DC signal also store voltage to charge to all components in the circuit.
- **Variable resistor 10kOhm**: A variable resistor (potentiometer) used to set the reference voltage threshold at which the battery-low indication should activate.
- **Resistors (1kOhm, 10kOhm, 100kOhm, 470 Ohm, 470k Ohm)**: Resistors are used to limit or regulate the flow of electrical current in a circuit.
- **LED:** The indicator LED that flickers to signal that the battery voltage has fallen below the preset threshold.

3. **Procedure (for running prototype circuit)**

Firstly, I buy all of the components of the circuit which I have received.

Secondly, I solder all the components at correct location of them on the PCB circtui

Thirdly, I check again all the places of component and connect the adapter 5V and see the current make the LED turning on. Then, I see LCD is activated.

Thirdly, I code and apply code into the Atmega32 by burn e code loading circuit.

Then, I check the performance of my circuit.

Finally, I made the report based on the result, or if the result is not true or did not run as expected, we can check the equality of components, and the connection among elements and redo again.

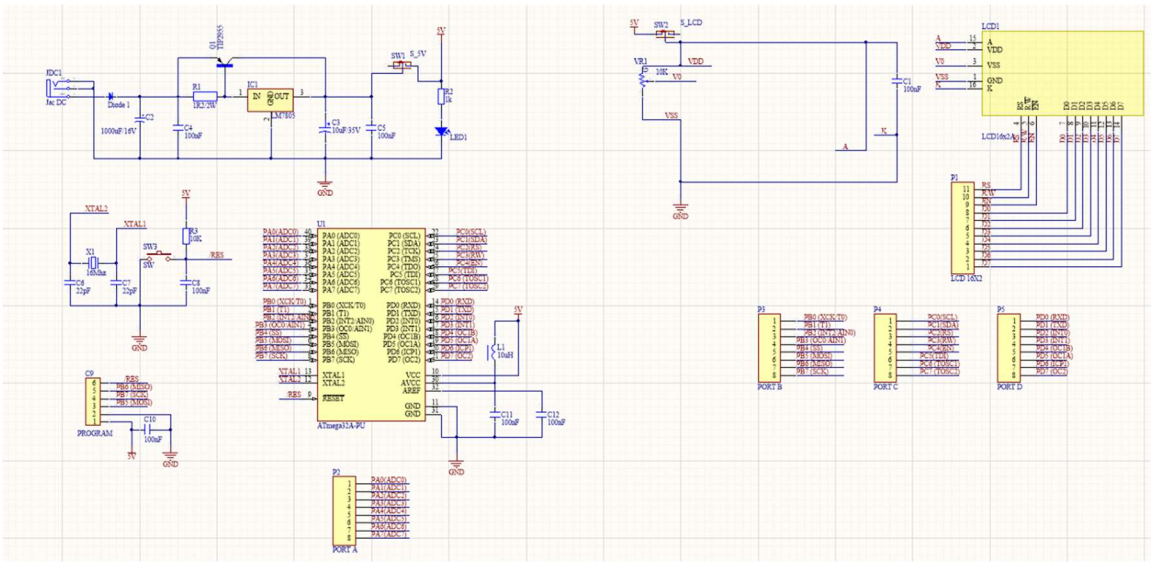

Figure 1. Schematic Circuit Diagram

4. **Operational mechanism**

The adapter provide 5V through jack, then TIP 2955 amplify the current from the adapter.

Atmega32 is responsible for loading code and control 4 port. If we connect right port and the circuit will work as the calculator with keypad 4x4

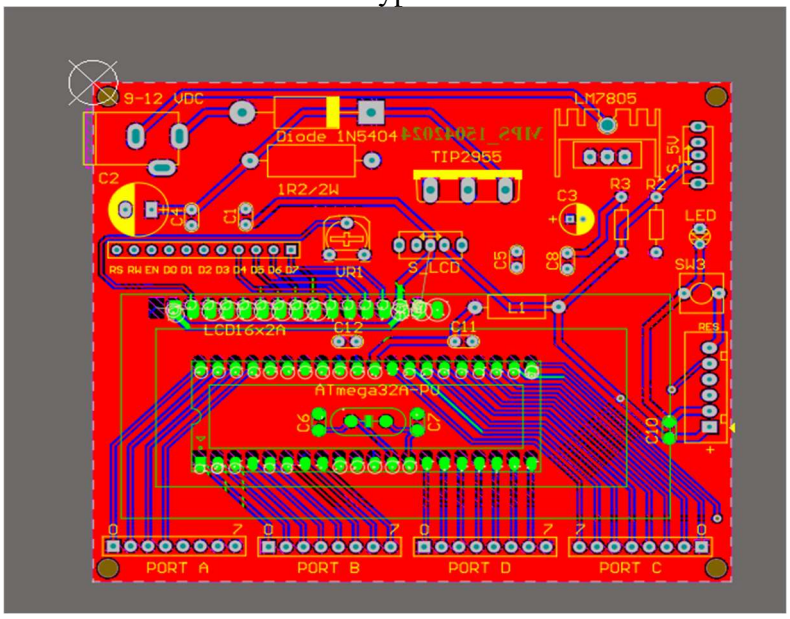

Figure 3. PCB Circuit Diagram Design on Altium

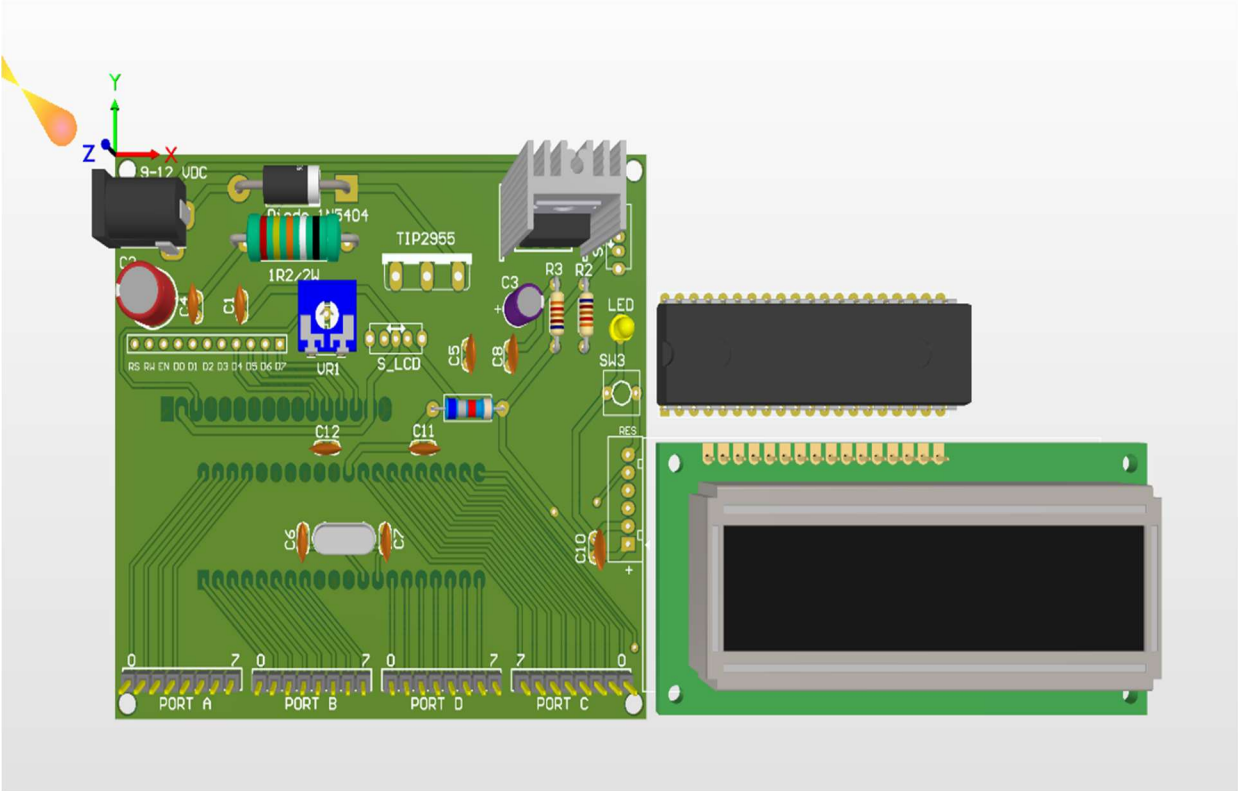

Figure 4. 3D PCB Circuit Diagram on Altium

Experimental Results

When I loading the code and connect all wire and keypad 4x4, the LCD display “Atmega32 calculator in the first line and the second line is “Thu Ngan”. Then when I press the number input, the LCD will display correct that number and excute the basic operand : addition, substraction, multipliaction, division and show me the result on the screen

Figure 5. Demo Circuit Diagram on PCB

Discussion of Results

The process from designing to getting the real circuit went smoothly, there were not too many difficulties, and it remained in my control. The PCB circuit, when I soldered all the components on it. Then it work very smoothly, however, I have some problems with connecting wire since the places to large but the end of wire is smaller and it is very loose.

Hence, I need to make sure the wires are securely connected.

Self-Evaluation

- Technical Knowledge: I expanded our understanding of building circuits using Proteus software to design PCB circuits.

- Time Management: I honed our ability to manage time effectively. Despite encountering substantial information and unforeseen problems, we managed to complete the PCB circuit and submit it on time.

- Problem-Solving Skills: I developed greater flexibility in addressing and resolving issues as they arose.

- Circuit Design: I learned methodologies for constructing and integrating all components of a circuit in a coherent and efficient manner.

Overall, the project was a valuable learning experience, enhancing our technical skills, teamwork, and problem-solving abilities. With the knowledge gained, we are better equipped to tackle future projects more effectively.